REMARKS

Claims 1, 4, and 10-28 are all the claims presently pending in the application.

It is noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 16-23 stand as constructively withdrawn as being a non-elected invention. Applicant has amended these claims to clarify a correspondence with the invention described by claim 1, thereby removing the reason for the Examiner's constructive withdrawal.

The Examiner objects to claim 11 and 14. Claim 15 stands as rejected under 35 USC §112, first paragraph, as failing the written description requirement. Claims 24 and 25 stand rejected under 35 USC §102(e) as being anticipated by US Patent 6,188,818 to Han et al. Claims 1, 10-12, and 26 stand rejected under 35 USC §103(a) as being unpatentable over Han, further in view of US Patent 6.06,990 to Okawa. Claims 4, 13, 27, and 28 stand rejected under 35 USC §103(a) as unpatentable over Han, further in view of Okawa, and further in view of Japanese Patent JP 10-197735 to Okamoto. Claim 14 stands rejected under 35 USC §103(a) as unpatentable over Han, further in view of Okawa, and further in view of US Patent 5,002,350 to Dragone.

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

Applicant's invention, as disclosed and defined in claim 1, is directed to an arrayed waveguide grating including a substrate, a first channel waveguide disposed on the substrate, a channel waveguide array disposed on the substrate and constituted such that each length of

waveguides is sequentially longer with a predetermined difference between the lengths of the waveguides.

A first slab waveguide is disposed on the substrate and connects the first channel waveguide with the channel waveguide array. A second slab waveguide is disposed on the substrate and connects an end of the channel waveguide array on the side that the first slab waveguide has not been connected thereto. A second channel waveguide is disposed on the substrate and connected to the other end of said second slab waveguide. A waveguide part in the connected area has a parabolic configuration.

As a result, problems with a parabolic loss characteristic due to sudden changes in output levels and modulation problems due to narrowed transmission widths in the case of connected arrayed waveguide gratings are reduced (Application, p. 2, lines 25-29).

In complete contrast, a conventional arrayed waveguide grating repeats loss characteristics with respect to optical frequency and exhibits a more precipitous parabolic configuration in the vicinity of the central frequency. Thus, communications problems emerge where a wavelength of a laser light source deviates from its central frequency and optical modulation components are easily cut off (e.g., see specification, p. 3, lines 15-25).

In a key feature of an exemplary embodiment of the present invention, the waveguide part in the connected area of the second (output) channel waveguide is formed parabolic. A key advantage of this exemplary configuration is that the waveform outputted through the second channel can be flattened and the waveform flattening can be adjusted independently for each of the output channel waveguides (e.g., for each wavelength $\lambda 1$ through λn).

II. THE SPECIFICATION OBJECTIONS

In paragraph 5 on page 3 of the Office Action, the Examiner made a number of objections to the specification. Each of these objections is hereinbelow addressed, in the order listed in the Office Action.

A. Applicant submits that "Wt" in line 25 of page 16 is indeed correct, since Figure 6 clearly shows that the core opening width as being "Wt". Therefore, no specification revision is required.

B. Applicant submits that lines 4-7 on page 17 does read in readily understood English. Therefore, no specification is made at this time. The Examiner is invited to make suggestions considered in her mind to read better.

C. Applicant submits that "Wp" in line 22 of page 17 is indeed correct, since Figure 7 clearly shows the core opening width to be "Wp" for parabolic waveguide part 151. Therefore, no specification revision is required.

D. Applicant submits that the Examiner misunderstands the significance of parameter α. It is true that this parameter is discussed in terms of being a constant in one environment and a variable in another environment. This constant/variable characteristic of this parameter is indeed correct.

Applicant points out that, in engineering, parameters often take on the characteristic of a constant in one environment and the characteristic of a variable in another environment, particularly when the nature of the parameter itself is discussed separately from a discussion of a specific application of the parameter. Therefore, no specification revision is required.

E. Applicant has rewritten this paragraph.

F. Applicant has rewritten this paragraph.

G. Applicant has rewritten this paragraph.

H. Applicant has revised "tempered" to be "tapered" in this paragraph.

I. Applicant disagrees with the Examiner's statements by pointing out that no case law mandates the gist of the Examiner's statements. The purpose of the specification is that of teaching the invention to one of ordinary skill in the art. Contrary to the Examiner's statements, details of style and content are not mandated by case law. However, in order to expedite prosecution, Applicant has rewritten these paragraphs.

Applicant accordingly requests that the Examiner reconsider and withdraw the above-identified specification objections.

III. THE DRAWING OBJECTIONS

In paragraphs 7-10 on pages 3 and 4 of the Office Action, the Examiner made a number of objections to the drawings. Each of these objections is hereinbelow addressed, in the order listed in the Office Action.

1. Applicant submits a drawing change to add "L" to Figure 8.

2. Applicant submits that "Z" is discussed at lines 20 and 22 on page 18 and that "W" is discussed at line 21 on page 20. Therefore, Applicant submits that no drawing revisions are required.

3. Applicant submits a drawing change to Figure 3 to change MUX to DMUX in box labeled 108.

4. Applicant respectfully declines to refer to Figure 10 as "Prior Art", since it applies equally to aspects of the present invention, as discussed on page 20.

Applicant accordingly requests that the Examiner reconsider and withdraw the above-identified drawing objections.

IV. THE CLAIM OBJECTIONS

In paragraphs 11 and 12, beginning on page 4 of the Office Action, the Examiner made objections to two claims. Each of these objections is hereinbelow addressed, in the order listed in the Office Action.

1. Applicant submits that "Z" is shown in Figure 8 and discussed in the two paragraphs beginning at line 16 on page 18. Equation 1 on line 21 of page 18 provides the antecedent basis for the equation in the claim. The Examiner errs in assuming that every word, every phrase, and every equation in a claim must appear in a drawing. Applicant submits that no drawing revision is required for this objection.

2. Applicant has amended claim 14 to eliminate "sector".

Applicant accordingly requests that the Examiner reconsider and withdraw the above-identified claim objections.

V. THE 35 USC §112, FIRST PARAGRAPH REJECTION

Claim 15 stands rejected under 35 USC §112, first paragraph. Applicant has amended this claim above to address the Examiner's concern.

Applicant accordingly requests that the Examiner reconsider and withdraw this rejection.

VI. THE PRIOR ART REJECTIONS

The invention exemplarily defined in claim 1 has the feature that only the waveguide part in the connected area of the second (output) channel waveguide is formed parabolic. A key advantage of this version of the present invention is that the waveform outputted through the second channel can be flattened and the waveform flattening can be adjusted independently for each of the output channel waveguides (e.g., for each wavelength λ1 through λn).

In contrast, Han (US Patent 6,188,818) clearly discloses a tapered waveguide 317 interposed between the output terminal of the second slab waveguide and the output waveguide 318 (column 5 at lines 46-48; Figures 2 and 3). As explained beginning at line 25 of page 2 and at line 21 on page 25 through line 7 of page 26, the tapered waveguide 317 does not offer the flattening of the parabolic configuration.

Okawa '990 (US Patent 6,069,990) and '735 (JP10-197735) disclose a parabolic configuration disposed between the input waveguide and input terminal of the input slab waveguide. In '990 and '735, although the waveform outputted through the output channel waveguide can be flattened, the waveform flattening is not adjusted independently for each of the channel waveguides (e.g., for each wavelength λ1 through λn). Namely, the waveform outputted is flattened commonly in all wavelengths λ1 through λn. That is, because there is a single input waveguide used in inputting light, even if this single input waveguide is formed parabolically, the waveforms outputted therefrom must be flattened commonly.

Dragone (US Patent 5,002,350) discloses that both input waveguides and output waveguides at the connection section with the input/output slab waveguides are formed in curved configurations. However, these curves are not parabolic, since there is no equation therein to provide the parabolic shape.

Second, even if both input waveguides and output waveguides in Dragone were formed in parabolic curves, the waveform outputted therefrom could not be flattened. That is, when both the input waveguide and output waveguide is formed in a parabolic curve, the coupling efficiency between respective waveguides (at the connection part of the input/output waveguides with the input/output slab waveguides) must be increased (see Abstract of Dragone). Thus, the loss must be reduced and, therefore, the waveform outputted cannot be flattened.

The Examiner alleges that US Patent 6,188,818 to Han et al. anticipates the present invention as defined by claims 24 and 25.

However, a key feature of the present invention is the use of channel waveguide array (e.g., see item 135 in Figure 5).

The Examiner alleges that the channel waveguide array 114 in Han is "parabolized". However, the waveguide array 114 in Figure 1 and waveguide array 214 in Figure 2 is clearly not shaped so that the individual channel waveguides respectively form a parabola.

Hence, turning to the clear language of claim 24, there is no teaching or suggestion of: "... a parabolized channel waveguide array, disposed on said substrate, comprising a plurality of waveguides of differing lengths, each waveguide in said plurality of waveguides formed in a routing that is shaped to form a parabola...."

It should be apparent from comparing the waveguide array 135 of Figure 5 of the present application with the waveguide array 214 of Figure 2 of Han that the shape of the routing in Han does not form parabolas, especially in the top four channel waveguides.

For this reason alone, the present invention, as defined by claims 24 and 25 are fully allowable over Han.

Relative to the rejection for claim 1,

Concerning claim 1, the Examiner concedes that Han fails to "teach a parabolic configuration for the waveguide part" and relies upon Okawa to overcome this deficiency.

However, there are at least two problems with the Examiner's analysis. First, the primary reference Han is understood, at line 66 of column 2 through line 27 of column 3, as teaching against simply substituting parabolic horn waveguides for tapered waveguides.

Second, even if the parabolic part (e.g., item 5 in Figures 2B and 3B) of Okawa were to be incorporated into Han, the combination would still not result in the definition in claim 1, wherein the parabolic configuration is incorporated into the the second channel waveguide of the second slab waveguide. That is, as shown in Figure 7, the parabolic configuration part 151 is defined as being incorporated in the output side of the second sector form slab waveguide 137.

In contrast, Okawa clearly shows the parabolic configuration as being incorporated into the first slab waveguide 3, similar to the configuration shown in Figure 10 of the present application. The Examiner's reliance upon lines 35-41 of column 7 is misplaced, since these lines merely state that the optical mux/demux can be operated as a mux, rather than a demux. However, this capacity to reverse input signal directions is a different concept from that of saying that the first slab waveguide in a mux/demux becomes the second slab waveguide when the signal direction is reversed.

Hence, turning to the clear language of claim 1, there is no teaching or suggestion in Han or in Han/Okawa of: "... a first slab waveguide disposed on said substrate and connecting said first channel waveguide with said channel waveguide array; a second slab waveguide disposed on said substrate and connecting an end of said channel waveguide array on the side

wherein said first slab waveguide has not been connected thereto with an end thereof; and a second channel waveguide disposed on said substrate and connected to the other end of said second slab waveguide, wherein a waveguide part in the connected area has a parabolic configuration."

Relative to the rejection for claims 4, 13, 27, and 28, the lines cited by the Examiner (e.g., lines 19-25 of column 7) do not refer to the parabolic portion of the Okawa waveguide but, rather, to the tapered portion. Nor do these lines suggest what "design parameter of each waveguide" is involved. Moreover, Okamoto has the parabolic portions on the first slab waveguide, rather than the second slab waveguide.

Relative to the rejection for claim 14, equation 8 in column 6 of US Patent 5,002,350 to Dragone is a sine function, not a parabola as characterized by the Examiner.

For at least the reasons stated above, Applicant respectfully submits that the cited references fail to teach or suggest every feature of present invention as defined by claims 1, 4, and 10-28.

Based on the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejection.

VI. INFORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1, 4, and 10-28, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance.

Should the Examiner find the application to be other than in condition for allowance, the Examiner may contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorneys Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 10/31/03

Frederick E. Cooperrider
Reg. No. 36,769

McGinn & Gibb, PLLC
8321 Old Courthouse Road, Suite 200
Vienna, VA 22182-3817
(703) 761-4100
Customer No. 21254

CERTIFICATION OF TRANSMISSION

I certify that I transmitted via facsimile (703) 872-9319 (Official Facsimile Number for Technology Center TC2800, After-Final Fax Number) this Amendment to Examiner Krystyna Suchecki on October 31, 2003.

Frederick E. Cooperrider, Reg. No. 36,769